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ABSTRACT

OF A

DISSERTATION

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CONCERNING THE

SYSTEM OF THE EARTH,

ITS DURATION, AND STABILITY.

Dr. Lind Windsor
from James Hutton

G.R. III

ABSTRACT, &c.

THE purpoſe of this Diſſertation is to form ſome eſtimate with regard to the time the globe of this Earth has exiſted, as a world maintaining plants and animals; to reaſon with regard to the changes which the earth has undergone; and to ſee how far an end or termination to this ſyſtem of things may be perceived, from the conſideration of that which has already come to paſs.

As it is not in human record, but in natural hiſtory, that we are to look for the means of aſcertaining what has already been, it is here propoſed to examine the appearances of the earth, in order to be informed of operations which have been tranſacted in time paſt. It is thus that, from principles of natural philoſophy, we may arrive at ſome knowledge of order and ſyſtem in the oeconomy of this globe, and may form a rational opinion with regard to the courſe of nature, or to events which are in time to happen.

The ſolid parts of the preſent land appear, in general, to have been compoſed of the productions of the ſea, and of other materials ſimilar to thoſe now found upon the ſhores. Hence we find reaſon to conclude,

1*ſt*, That the land on which we reſt is not ſimple and original, but that it is a compoſition, and had been formed by the operation of ſecond cauſes.

2*dly*, That, before the preſent land was made, there had ſubſiſted a world compoſed of ſea and land, in which were tides and currents, with ſuch operations at the bottom of the ſea as now take place. And,

Laſtly, That, while the preſent land was forming at the bottom of the ocean, the former land maintained plants and animals; at leaſt, the ſea was then inhabited by animals, in a ſimilar manner as it is at preſent.

Hence we are led to conclude, that the greater part of our land, if not the whole, had been produced by operations natural to this globe; but that, in order to make this land a permanent body, reſiſting the operations of the waters, two things had been required;

red; 1*ſt*, The * conſolidation of maſſes formed by collections of looſe or incoherent materials; 2*dly*, The elevation of thoſe conſolidated maſſes from the bottom of the ſea, the place where they were collected, to the ſtations in which they now remain above the level of the ocean.

Here are two different changes, which may ſerve mutually to throw ſome light upon each other; for, as the ſame ſubject has been made to undergo both theſe changes, and as it is from the examination of this ſubject that we are to learn the nature of thoſe events, the knowledge of the one may lead us to ſome underſtanding of the other.

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* There are two ſenſes in which the term *ſolidity* is uſed; one of theſe is in oppoſition to *fluidity*, the other to *vacuity*. When the change from a fluid ſtate to that of ſolidity, in the firſt ſenſe, is to be expreſſed, we ſhall employ the term *concretion;* conſequently, the conſolidation of a maſs is only to be underſtood as in oppoſition to its vacuity, or porouſneſs.

Thus the ſubject is conſidered as naturally divided into two branches, to be ſeparately examined: *Firſt*, by what natural operation ſtrata of looſe materials had been formed into ſolid maſſes; *ſecondly*, By what power of nature the conſolidated ſtrata at the bottom of the ſea had been transformed into land.

With regard to the *firſt* of theſe, the conſolidation of ſtrata, there are two ways in which this operation may be conceived to have been performed; firſt, by means of the ſolution of bodies in water, and the after concretion of theſe diſſolved ſubſtances, when ſeparated from their ſolvent; *ſecondly*, the fuſion of bodies by means of heat, and the ſubſequent congelation of thoſe conſolidating ſubſtances.

With regard to the operation of water, it is *firſt* conſidered, how far the power of this ſolvent, acting in the natural ſituation of thoſe ſtrata, might be ſufficient to produce the effect; and here it is found, that water alone, without any other agent, cannot be ſuppoſed capable of inducing ſolidity among the materials of ſtrata in that ſituation. It is, *2dly*, conſidered, how far, ſuppoſing water capable of conſolidating the ſtrata in that ſituation, it might be concluded, from examining natural appearances, that this had been actually the caſe? Here again, having proceeded upon this principle, that water could only conſolidate ſtrata with ſuch ſubſtances as it has the power to diſſolve, and having found ſtrata conſolidated with every ſpecies of ſubſtance, it is concluded, that ſtrata in general have not been conſolidated by means of aqueous ſolution.

With regard to the other probable means, heat and fuſion, theſe are found to be perfectly competent for producing the end in view, as every kind of ſubſtance may by heat be rendered ſoft, or brought into fuſion, and as ſtrata are actually found conſolidated with every different ſpecies of ſubſtance.

A more particular diſcuſſion is then entered into: Here, conſolidating ſubſtances are conſidered as being claſſed under two different heads, viz. Siliceous and ſulphureous bodies, with a view to prove, that it could not be by means of aqueous ſolution that ſtrata had been conſolidated with thoſe particular ſubſtances, but that their conſolidation had been accompliſhed by means of heat and fuſion.

Sal Gem, as a ſubſtance ſoluble in water, is next conſidered, in order to ſhow that this body had been laſt in a melted ſtate; and this example is confirmed by one of foſſile alkali. The caſe of particular ſectaria of iron-ſtone, as well as certain cryſtallized cavities in mineral bodies, are then given as examples of a ſimilar fact; and as containing, in themſelves, a demonſtration, that all the various mineral ſubſtances had been concreted and cryſtallized immediately from a ſtate of fuſion.

Having thus proved the actual fuſion of the ſubſtances with which ſtrata had been conſolidated, in having ſuch fluid bodies introduced among their interſtices, the caſe of ſtrata, conſolidated by means of the ſimple fuſion of their proper materials, is next conſidered;

ed; and examples are taken from the moſt general ſtrata of the globe, viz. ſiliceous and calcareous. Here alſo demonſtration is given, that this conſolidating operation had been performed by means of fuſion.

Having come to this general concluſion, that heat and fuſion, not aqueous ſolution, had preceded the conſolidation of the looſe materials collected at the bottom of the ſea, thoſe conſolidated ſtrata, in general, are next examined, in order to diſcover other appearances, by which the doctrine may be either confirmed or refuted. Here the changes of ſtrata, from their natural ſtate of continuity, by veins and fiſſures, are conſidered; and the cleareſt evidence is hence deduced, that the ſtrata have been conſolidated by means of fuſion, and not by aqueous ſolution; for, not only are ſtrata in general found interſected with veins and cutters, an appearance inconſiſtent with their having been conſolidated ſimply by previous ſolution; but, in proportion as ſtrata are more or leſs conſolidated, they are found with the proper correſponding appearances of veins and fiſſures.

With regard to the ſecond branch, in conſidering by what power the conſolidated ſtrata had been transformed into land, or raiſed above the level of the ſea, it is ſuppoſed that the ſame power of extreme heat, by which every different mineral ſubſtance had been brought into a melted ſtate, might be capable of producing an expanſive force, ſufficient for elevating the land, from the bottom of the ocean, to the place it now occupies above the ſurface of the ſea. Here we are again referred to nature, in examining how far the ſtrata, formed by ſucceſſive ſediments or accumulations depoſited at the bottom of the ſea, are to be found in that regular ſtate, which would neceſſarily take place in their original production; or if, on the other hand, they are actually changed in their natural ſituation, broken, twiſted, and confounded, as might be expected, from the operation of ſubterranean heat, and violent expanſion. But, as ſtrata are actually found in every degree of fracture, flexure, and contortion, conſiſtent with this ſuppoſition, and with no other, we are led to conclude, that our land had been raiſed above the ſurface of the ſea, in order to become a habitable world; as well as that it had been conſolidated by means of the ſame power of ſubterranean heat, in order to remain above the level of the ſea,

and

and to reſiſt the violent efforts of the ocean.

This theory is next confirmed by the examination of mineral veins, thoſe great fiſſures of the earth, which contain matter perfectly foreign to the ſtrata they traverſe; matter evidently derived from the mineral region, that is, from the place where the active power of fire, and the expanſive force of heat, reſide.

Such being conſidered as the operations of the mineral region, we are hence directed to look for the manifeſtation of this power and force, in the appearances of nature. It is here we find eruptions of ignited matter from the ſcattered volcano's of the globe; and theſe we conclude to be the effects of ſuch a power preciſely as that about which we now inquire. Volcano's are thus conſidered as the proper diſcharges of a ſuperfluous or redundant power; not as things accidental in the courſe of nature, but as uſeful for the ſafety of mankind, and as forming a natural ingredient in the conſtitution of the globe.

The doctrine is then confirmed, by examining this earth, and by finding every where, beſide the many marks of ancient volcano's, cano's, abundance of ſubterraneous or unerupted lava, in the baſaltic rocks, the Swediſh trap, the toadſtone, ragſtone, and whinſtone of Britain and Ireland, of which particular examples are cited; and a deſcription given of the three different ſhapes in which that unerupted lava is found.

The peculiar nature of this ſubterraneous lava is then examined; and a clear diſtinction is formed between this baſaltic rock and the common volcanic lavas.

Laſtly, The extenſion of this theory, reſpecting mineral ſtrata, to all parts of the globe, is made, by finding a perfect ſimilarity in the ſolid land through all the earth, although, in particular places, it is attended with peculiar productions, with which the preſent inquiry is not concerned.

A theory is thus formed, with regard to a mineral ſyſtem. In this ſyſtem, hard and ſolid bodies are to be formed from ſoft bodies, from looſe or incoherent materials, collected together at the bottom of the ſea; and the bottom of the ocean is to be made to change its place with relation to the centre of the earth, to be formed into land above the level of the ſea, and to become a country fertile and inhabited.

That there is nothing viſionary in this theory, appears from its having been rationally deduced from natural events, from things which have already happened; things which have left, in the particular conſtitutions of bodies, proper traces of the manner of their production; and things which may be examined with all the accuracy, or reaſoned upon with all the light, that ſcience can afford. As it is only by employing ſcience in this manner, that philoſophy enlightens man with the knowledge of that wiſdom or deſign which is to be found in nature, the ſyſtem now propoſed, from unqueſtionable principles, will claim the attention of ſcientific men, and may be admitted in our ſpeculations with regard to the works of nature, notwithſtanding many ſteps in the progreſs may remain unknown.

By thus proceeding upon inveſtigated principles, we are led to conclude, that, if this part of the earth which we now inhabit had been produced, in the courſe of time, from the materials of a former earth, we ſhould, in the examination of our land, find data from which to reaſon, with regard to the nature of that world, which had exiſted during the period of time in which the preſent earth was forming; and thus we might be brought to underſtand the nature of that earth which had preceded this; how far it had been ſimilar to the preſent, in producing plants and nouriſhing animals. But this intereſting point is perfectly aſcertained, by finding abundance of every manner of vegetable production, as well as the ſeveral ſpecies of marine bodies, in the ſtrata of our earth.

Having thus aſcertained a regular ſyſtem, in which the preſent land of the globe had been firſt formed

formed at the bottom of the ocean, and then raiſed above the ſurface of the ſea, a queſtion naturally occurs with regard to time; what had been the ſpace of time neceſſary for accompliſhing this great work?

In order to form a judgment concerning this ſubject, our attention is directed to another progreſs in the ſyſtem of the globe, namely, the deſtruction of the land which had preceded that on which we dwell. Now, for this purpoſe, we have the actual decay of the preſent land, a thing conſtantly tranſacting in our view, by which to form an eſtimate.

This decay is the gradual ablution of our ſoil, by the floods of rain; and the attrition of the ſhores, by the agitation of the waves.

If we could meaſure the progreſs of the preſent land, towards its diſſolution by attrition, and its ſubmerſion in the ocean, we might diſcover the actual duration of a former earth; an earth which had ſupported plants and animals, and had ſupplied the ocean with thoſe materials which the conſtruction of the preſent earth required; conſequently, we ſhould have the meaſure of a correſponding ſpace of time, viz. that which had been required in the production of the preſent land. If, on the contrary, no period can be fixed for the duration or deſtruction of the preſent earth, from our obſervations of thoſe natural operations, which, though unmeaſurable, admit of no dubiety, we ſhall be warranted in drawing the following concluſions; 1*ſt*, That it had required an indefinite ſpace of time to have produced the land which now appears; 2*dly*, That an equal ſpace had been employed upon the conſtruction of that former land from whence the materials of the preſent came; *laſtly*, That there is preſently laying at the bottom of the ocean the foundation of future land, which is to appear after an indefinite ſpace of time.

But, as there is not in human obſervation proper means for meaſuring the waſte of land upon the globe, it is hence inferred, that we cannot eſtimate the duration of what we ſee at preſent, nor calculate the period at which it had begun; ſo that, with reſpect to human obſervation, this world has neither a beginning nor an end.

An endeavour is then made to ſupport the theory by an argument of a moral nature, drawn from the conſideration of a final cauſe. Here a compariſon is formed between the preſent theory, and thoſe by which there is neceſſarily implied either evil or diſorder in natural things; and an argument is formed, upon the ſuppoſed wiſdom of nature, for the juſtneſs of a theory in which perfect order is to be perceived. For,

According to the theory, a ſoil, adapted to the growth of plants, is neceſſarily prepared, and carefully preſerved; and, in the neceſſary waſte of land which is inhabited, the foundation is laid for future continents, in order to ſupport the ſyſtem of this living world.

Thus, either in ſuppoſing Nature wiſe and good, an argument is formed in confirmation of the theory, or, in ſuppoſing the theory to be juſt, an argument may be eſtabliſhed for wiſdom and benevolence to be perceived in nature. In this manner, there is opened to our view a ſubject intereſting to man who thinks; a ſubject on which to reaſon with relation to the ſyſtem of nature; and one which may afford the human mind both information and entertainment.